

MLLNVLRICI	IVCLVNDGAG	KHSEGRERTK	TYSLNSRGYF	40
RKERGARRSK	ILLVNTKGLD	EPHIGHGDFG	LVAELFDSTR	80
THTNRKEPDM	NKVKLFSTVA	HGNKSARRKA	YNGSRRNIFS	120
RRSFDKRNTE	VTEKPGAKMF	WNNFLVKMNG	APQNTSHGSK	160
AQEIMKEACK	TLPFTQNIVH	ENCDRMVIQN	NLCFGKCISL	200
HVPNQODRRN	TCSHCLPSKF	TLNHLTLNCT	GSKNVVKVVM	240
MVEECTCEAH	KSNFHQTAQF	NMDTSTTLHH		270

Figure 1. Deduced amino acid sequence of *Xenopus cerberus* protein. SEQ ID NO:1.

Figure 2. Nucleotide sequence of the full-length cerberus DNA derived from the Xenopus organizer. The sense strand is on top (in the 5' to 3' direction) and the antisense strand on the bottom line (on the opposite direction). SEQ ID NO:2.

GAATTC	CCCAG	CAAGTC	GCTC	AGAAAC	ACTG	CAGGGT	CTAG	ATATCA	TACA	ATGTTA	CTAA	60
CTTAAG	GGTC	GTTCAG	CGAG	TCTTTG	TGAC	GTCCAG	ATC	TATAGT	TATGT	TACAAT	GATT	
ATGTACT	CAG	GATCTG	TATT	ATCGT	CTGCC	TTGTGA	ATGA	TGGAGC	AGGA	AAACACT	CAG	120
TACATG	AGTC	CTAGACA	TAA	TAGCAG	ACGG	AACACT	TACT	ACCTCG	TCT	TTGTG	AGTC	
AAGGAC	GAGA	AAGGAC	AAAA	ACATATT	CAC	TTAACAG	CAG	AGGTTA	CTTC	AGAAA	AGAAA	180
TTCTG	CTCT	TTCCTG	TTTT	TGTATA	AGTG	AATTGT	CGTC	TCCAAT	GAAG	TCTTTT	CTTT	
GAGGAG	CACG	TAGGAG	CAAG	ATTCTG	CTGG	TGAATA	CTAA	AGGTCT	TGAT	GAACCC	CACA	240
CTCCTC	GTGC	ATCCTC	GTTC	TAAGAC	GACC	ACTTAT	GATT	TCCAGA	AACTA	CTTGGG	GTGT	
TTGGGC	CATGG	TGATTTT	TCG	TTAGTAG	CTG	AACATTT	TGA	TTCCACC	GAGA	ACACATA	CAA	300
AACCCG	TACC	ACTAAA	AGCG	AATCAT	CGAC	TTGATA	AACT	AAGGTG	GTCT	TGTGTAT	GTT	
ACAGAAA	AGA	GCCAGAC	ATG	AACAAAG	TCA	AGCTTTT	CTC	AACAGTT	GCC	CATGGAA	ACA	360
TGCTTTT	TCT	CGGTCT	GTAC	TTGTTT	CAGT	TCGAAA	AGAG	TTGTCA	ACGG	GTACCTT	TGT	
AAAGTG	CAAG	AAGAAA	AGCT	TACAAT	G GTT	CTAGA	AGGAA	TATTTT	TCCT	CGCCGT	TCTT	420
TTTACG	GTTC	TTCTTTT	CGA	ATGTTA	CCAA	GATCTT	CCCT	ATAAAA	AGGA	GCGGCA	AGAA	
TTGATA	AAAG	AAATAC	AGAG	GTTACT	GAAA	AGCCTG	GTGC	CAAGAT	GTTC	TGGAACA	AATT	480
AACTATT	TTTC	TTTATG	TCTC	CAATGAC	TTT	TCGGAC	CACG	GTTCTA	CAAG	ACCTTG	TAA	
TTTTGG	TAA	AATGAAT	GGA	GCCCCA	CAGA	ATACA	AGCCA	TGGCAG	TAA	GCACAG	GAAA	540
AAAACCA	AATT	TTACTT	ACCT	CGGGGT	GTCT	TATGTT	CGGT	ACCGT	CATT	CGTGT	CTTT	
TAATGA	AAGA	AGCTTG	CAAA	ACCTTG	TTTT	TCACTC	AGAA	TATTGT	ACAT	GAAAAC	TGTG	600
ATTACT	TTTCT	TCGAAC	GTTT	TGGAACA	AAAA	AGTGAG	TCTT	ATAAC	ATGTA	CTTTT	GACAC	
ACAGGAT	GGT	GATACAG	AAC	AATCTG	TGCT	TTGGTA	AATG	CATCTC	TCTC	CATGTT	CCAA	660
TGTCCT	TACCA	CTATGT	CTTG	TTAGAC	CACGA	AACCATT	TAC	GTAGAG	AGAG	GTACA	AGGT	
ATCAGCA	AGA	TCGACG	AAAT	ACTTGT	TCCC	ATTGCT	TGCC	GTCCAA	ATTT	ACCTG	AACC	720
TAGTCG	TTCT	AGCTGC	TTTA	TGAACA	AGGG	TAACGA	ACGG	CAGGTT	TAAA	TGGGAC	TTGG	
ACCTGAC	GCT	GAATTG	TACT	GGATCT	AAGA	ATGTAG	TAAA	GGTTGT	CATG	ATGGT	AGAG	780
TGGACT	GCGA	CTTAAC	ATGA	CCTAG	ATTCT	TACAT	CATT	CCAAC	AGTAC	TACCAT	CTCC	
AATGCAC	GTG	TGAAGC	TCAT	AAGAGC	AACT	TCCACCA	AAAC	TGCAC	AGTTT	AACATG	GATA	840
TTACGT	GAC	ACTTCG	AGTA	TTCTCG	TTGA	AGGTG	GTTG	ACGTG	TCAA	TTGTAC	CTAT	
CATCTAC	TAC	CCTGC	ACCAT	TAAAGG	ACTG	CCATAC	AGTA	TGGAA	ATGCC	CTTTT	GTTGG	900
GTAGAT	GATG	GGACGT	G GTA	ATTTCT	GAC	GGTATG	TCAT	ACCTT	ACGG	GAAAAC	AACC	
AATATTT	GTT	ACATACT	ATG	CATCTA	AAGC	ATTATG	TTGC	CTTCT	ATTT	ATATA	ACCAC	960
TTATAA	CAAA	TGTATG	ATAC	GTAGAT	TTTCG	TAATACA	ACG	GAAGAT	AAG	TATATT	G GTG	
ATGGA	ATAAG	GATTGT	ATGA	ATTATA	ATTA	ACAAAT	GGCA	TTTTGT	GTAA	CATGCA	AGAT	1020
TACCTT	ATTC	CTAACAT	ACT	TAATATT	AAT	TGTTT	ACCGT	AAAAC	ACATT	GTACGT	TCTA	

MSRTRKVDL LLLAIPGLAL LLLPNAYCAS CEPVRIPMCK SMPWNMTKMP NHLHHSTQAN 60
AILAIEQFEG LLTTECSQDL LFFLCAMYAP ICTIDFQHEP IKPCKSV CER ARAGCEPILI 120
KYRHTWPESL ACEELPVYDR GVCISPEAIV TVEQGTDSMP DFSMDSNNGN CGSGREHCKC 180
KPMKATQKTY LKNNYNYVIR AKVKEVKVVC HDATAIVEVK EILKSSLVNI PKDTVTLYTN 240
SGCLCPQLVA NEEYIIMGYE DKERTRLLLV EGSLAEKWRD RLAKKVKRWD QKLRRPRKSK 300
DPVAPIPNKN SNSRQARS

Figure 3. Deduced amino acid sequence of Xenopus frazzled protein. SEQ ID NO:3.

Figure 4. Nucleotide sequence of the full-length frazzled cDNA derived from the *Xenopus* organizer. The sense strand of the DNA on top (5' to 3' direction) and the antisense strand on the bottom line (opposite direction). SEQ ID NO:4.

GAATTCCTT TCACACAGGA CTCCTGGCAG AGGTGAATGG TTAGCCCTAT GGATTGTT	60
CTTAAGGGAA AGTGTGTCCT GAGGACCGTC TCCACTTACC AATCGGGATA CCTAAACCA	
TGTTGATTTT GACACATGAT TGATTGCTTT CAGATAGGAT TGAAGGACTT GGATTTTAT	120
ACAACTAAA CTGTGTACTA ACTAACGAAA GTCTATCCTA ACTTCCTGAA CCTAAAAATA	
CTAATCTGCG ACTTTTAAAT TATCTGAGTA ATTGTTCAAT TTGTATTGGA TGGGACTAAA	180
GATTAAGACG TGAAAATTTA ATAGACTCAT TAACAAGTAA AACATAACCT ACCCTGATTT	
GATAAACTTA ACTCCTTGCT TTTGACTTGC CCATAAACTA TAAGGTGGGG TGAGTTGTAG	240
CTATTTGAAT TGAGGAACGA AAAGTGAACG GGTATTTGAT ATTCCACCCC ACTCAACATC	
TTGCTTTTAC ATGTGCCCAG ATTTTCCCTG TATTCCCTGT ATTCCCTCTA AAGTAAGCCT	300
AACGAAAATG TACACGGGTC TAAAAGGGAC ATAAGGGACA TAAGGGAGAT TTCATTGCGA	
ACACATACAG GTTGGGCAGA ATAACAATGT CTCGAACAAG GAAAGTGGAC TCATTACTGC	360
TGTGTATGTC CAACCCGTCT TATTGTTACA GAGCTTGTTT CTTTCACCTG AGTAATGACG	
TACTGGCCAT ACCTGGACTG GCGCTTCTCT TATTACCCAA TGCTTACTGT GCTTCGTGTG	420
ATGACCGGTA TGGACCTGAC CGCGAAGAGA ATAATGGGT ACGAATGACA CGAAGCACAC	
AGCCTGTGCG GATCCCCATG TGCAAACTA TGCCATGGAA CATGACCAAG ATGCCCAACC	480
TGGACACGCG CTAGGGGTAC ACGTTTAGAT ACGGTACCTT GTACTGGTTC TACGGGTTGG	
ATCTCCACCA CAGCACTCAA GCCAATGCCA TCCTGGCAAT TGAACAGTTT GAAGGTTTGC	540
TAGAGGTGGT GTCGTGAGTT CGGTTACGGT AGGACCGTTA ACTTGTCAA CTTCCAAACG	
TGACCACTGA ATGTAGCCAG GACCTTTTGT TCTTTCTGTG TGCCATGTAT GCCCCATTT	600
ACTGGTGACT TACATCGGTC CTGGAACA AGAAAGACAC ACGGTACATA CGGGGGTAAA	
GTACCATCGA TTTCCAGCAT GAACCAATTA AGCCTTGCAA GTCCGTGTGC GAAAGGGCCA	660
CATGGTAGCT AAAGGTCGTA CTTGGTTAAT TCGGAACGTT CAGGCACACG CTTTCCCGGT	
GGGCCGGCTG TGAGCCCATT CTCATAAAGT ACCGGCACAC TTGGCCAGAG AGCCTGGCAT	720
CCCGGCCGAC ACTCGGTAA GAGTATTTCA TGGCCGTGTG AACCAGTCTC TCGGACCGTA	
GTGAAGAGCT GCGCGTATAT GACAGAGGAG TCTGCATCTC CCCAGAGGCT ATCGTCACAG	780
CACCTTCTCGA CGGGCATATA CTGTCTCCTC AGACGTAGAG GGGTCTCCGA TAGCAGTGT	
TGGAACAAGG AACAGATTCA ATGCCAGACT TCTCCATGGA TTCAAACAAT GGAAATTGCG	840
ACCTTGTTCC TTGTCTAAGT TACGGTCTGA AGAGGTACCT AAGTTTGTTA CCTTTAACGC	
GAAGCGGCAG GGAGCACTGT AAATGCAAGC CCATGAAGGC AACCCAAAAG ACGTATCTCA	900
CTTCGCCGTC CCTCGTGACA TTTACGTTTC GGTACTTCCG TTGGGTTTTT TGCAATAGAGT	
AGAATAATTA CAATTATGTA ATCAGAGCAA AAGTGAAAGA GGTGAAAGTG AAATGCCACG	960
TCTTATTAAT GTTAATACAT TAGTCTCGTT TTCACCTTCT CCACTTTTAC TTTACGGTGC	
ACGCAACAGC AATTGTGGAA GTAAAGGAGA TTCTCAAGTC TTCCCTAGTG AACATTCCTA	1020
TGCGTTGTGC TTAACACCTT CATTTCTCT AAGAGTTCAG AAGGGATCAC TTGTAAGGAT	

AAGACACAGT	GACACTGTAC	ACCAACTCAG	GCTGCTTGTG	CCCCCAGCTT	GTTGCCAATG	1080
TTCTGTGTCA	CTGTGACATG	TGGTTGAGTC	CGACGAACAC	GGGGGTGAA	CAACGGTTAC	
AGGAATACAT	AATTATGGGC	TATGAAGACA	AAGAGCGTAC	CAGGCTTCTA	CTAGTGGAAG	1140
TCCTTATGTA	TTAATACCCG	ATACTTCTGT	TTCTCGCATG	GTCCGAAGAT	GATCACCTTC	
GATCCTTGGC	CGAAAAATGG	AGAGATCGTC	TTGCTAAGAA	AGTCAAGCGC	TGGGATCAAA	1200
CTAGGAACCG	GCTTTTTACC	TCTCTAGCAG	AACGATTCTT	TCAGTTCGCG	ACCCTAGTTT	
AGCTTCGACG	TCCCAGGAAA	AGCAAAGACC	CCGTGGCTCC	AATTCCCAAC	AAAAACAGCA	1260
TCGAAGCTGC	AGGGTCCTTT	TCGTTTCTGG	GGCACCGAGG	TTAAGGGTTG	TTTTTGTCTG	
ATTCCAGACA	AGCGCGTAGT	TAGACTAACG	GAAAGGTGTA	TGGAACTCT	ATGGACTTTG	1320
TAAGGTCTGT	TCGCGCATCA	ATCTGATTGC	CTTTCCACAT	ACCTTTGAGA	TACCTGAAAC	
AAACTAAGAT	TTGCATTGTT	GGAAGAGCAA	AAAAGAAATT	GCACTACAGC	ACGTTATATT	1380
TTTGATTCTA	AACGTAACAA	CCTTCTCGTT	TTTTCTTTAA	CGTGATGTCG	TGCAATATAA	
CTATTGTTTA	CTACAAGAAG	CTGGTTTAGT	TGATTGTAGT	TCTCCTTTCC	TTCTTTTTTT	1440
GATAACAAAT	GATGTTCTTC	GACCAAATCA	ACTAACATCA	AGAGGAAAGG	AAGAAAAAAA	
TTATACTAT	ATTTGCACGT	GTTCCCAGGC	AATTGTTTTA	TTCAACTTCC	AGTGACAGAG	1500
AATATTGATA	TAAACGTGCA	CAAGGGTCCG	TTAACAAAAT	AAGTTGAAGG	TCCTGTCTC	
CAGTGACTGA	ATGTCTCAGC	CTAAAGAAGC	TCAATTCATT	TCTGATCAAC	TAATGGTGAC	1560
GTCCTGACT	TACAGAGTCG	GATTTCTTCG	AGTTAAGTAA	AGACTAGTTG	ATTACCACTG	
AAGTGTTTGA	TACTTGGGGA	AAGTGAACTA	ATTGCAATGG	TAAATCAGAG	AAAAGTTGAC	1620
TTCACAAACT	ATGAACCCCT	TTCACTTGAT	TAACGTTACC	ATTTAGTCTC	TTTTCAACTG	
CAATGTTGCT	TTTCCTGTAG	ATGAACAAGT	GAGAGATCAC	ATTTAAATGA	TGATCACTTT	1680
GTTACAACGA	AAAGGACATC	TACTTGTTCA	CTCTCTAGTG	TAAATTACT	ACTAGTGAAA	
CCATTTAATA	CTTTCAGCAG	TTTTAGTTAG	ATGACATGTA	GGATGCACCT	AAATCTAAAT	1740
GGTAAATTAT	GAAAGTCGTC	AAAATCAATC	TACTGTACAT	CCTACGTGGA	TTTAGATTTA	
ATTTTATCAT	AAATGAAGAG	CTGGTTTAGA	CTGTATGGTC	ACTGTTGGGA	AGGTAAATGC	1800
TAAATAGTA	TTTACTTCTC	GACCAAATCT	GACATACCAG	TGACAACCCCT	TCCATTTACG	
CTACTTTGTC	AATTCTGTTT	TAAAAATTGC	CTAAATAAAT	ATTAAGTCCT	AAATAAAAAA	1860
GATGAAACAG	TTAAGACAAA	ATTTTAAACG	GATTTATTTA	TAATTCAGGA	TTTATTTTTT	
AAAAAAAAAA	AAAAA					
TTTTTTTTTT	TTTTT					

Fig. 4. (Continuation page 2, SEQ ID NO:4).

MLLLFRAIPM LLLGLMVLQT DCEIAQYYID EEEPPGTVIA VLSQHSIFNT TDIPATNFRL	60
MKQFNNSLIG VRESQGQLSI MERIDREQIC RQSLHCNLAL DVVSFSKGHF KLLNVKVEVR	120
DINDHSPHFP SEIMHVEVSE SSSVGTRIPL EIAIDEDVGS NSIQNFQISN NSHFSIDVLT	180
RADGVKYADL VLMRELDREI QPTYIMELLA MDGGVPSLSG TAVVNIRVLD FNDNSPVFER	240
STIAVDLVED APLGYLLEL HATDDDEGVN GEIVYGFSTL ASQEVRLFK INSRTGSVTL	300
EGQVDFETKQ TYEFEVQAQD LGPNPLTATC KVTVHILDVN DNTPAITITP LTTVNAGVAY	360
IPETATKENF IALISTTDRA SGSNGQVRCT LYGHEHFKLQ QAYEDSYMIV TTSTLDRENI	420
AAYSLTVVAE DLGFPSLTKK KYITVKVSDE NDNAFVFSKP QYEASILENN APGSYITTVI	480
ARDSDSQNG KVNRYLVDK VMGQSLTTFV SLDADSGVLR AVRSLDYEKL KQLDFEIEAA	540
DNGIPQLSTR VQLNLRIVDQ NDNCPVITNP LLNNGSGEVL LPISAPQNYL VFQLKAEDSD	600
EGHNSQLFYT ILRDPSRLFA INKESGEVFL KKQLNSDHSE DLSIVVAVYD LGRPSLSTNA	660
TVKFILTDSE PSNVEVVILQ PSAEEQHQID MSIIFIAVLA GGCALLLLAI FFVACTCKKK	720
AGEFKQVPEQ HGTCNEERLL STPSPQSVSS SLSQSESCQL SINTESENCV VSSNQEQHQQ	780
TGIKHSISVP SYHTSGWHLN NCAMSISGHS HMGHISTKVQ WAKEIVTSMT VTLILVENQK	840
RRALSSQCRH KPVLTQMNQ QGSDMPITIS ATESTRVQKM GTAHCNMKRA IDCLTL	

Figure 5. Deduced amino acid sequence of the *Xenopus* PAPC (paraxial protocadherin) protein. It encodes a member of the cadherin family of transmembrane proteins that has dorsalizing activity when constructs are injected into *Xenopus* embryos. SEQ ID NO:5.

Figure 6. Nucleotide sequence of the full-length PAPC cDNA derived from the *Xenopus* organizer. The sense strand of the DNA is shown in the top line (in the 5' to 3' direction), and the bottom line shows the antisense strand (opposite orientation). SEQ ID NO:6.

GAATTCCCAG AGATGAACTC CTGAGATTG TTTTAAATGA CTGCAGGTCT GGAAGGATTC	60
CTTAAGGGTC TCTACTTGAG GAACTCTAAC AAAATTTACT GACGTCCAGA CCTTCCCTAAG	
ACATTGCCAC ACTGTTTCTA GGCATGAAAA AACTGCAAGT TTCAACTTTG TTTTGGTGC	120
TGTAACGGTG TGACAAAGAT CCGTACTTTT TTGACGTTCA AAGTTGAAAC AAAAACCACG	
AACTTTGATT CTTCAAGATG CTGCTTCTCT TCAGAGCCAT TCCAATGCTG CTGTTGGGAC	180
TTGAAACTAA GAAGTTCTAC GACGAAGAGA AGTCTCGGTA AGGTTACGAC GACAACCCTG	
TGATGGTTTT ACAACAGAC TGTGAAATTG CCCAGTACTA CATAGATGAA GAAGAACCCC	240
ACTACCAAAA TGTTTGCTG ACACTTTAAAC GGGTCATGAT GTATCTACTT CTTCTTGGGG	
CTGGCACTGT AATTGCAGTG TTGTCACAAC ACTCCATATT TAACACTACA GATATACCTG	300
GACCGTGACA TTAACGTCAC AACAGTGTG TGAGGTATAA ATTGTGATGT CTATATGGAC	
CAACCAATTT CCGTCTAATG AAGCAATTTA ATAATTCCCT TATCGGAGTC CGTGAGAGTG	360
GTTGGTTAAA GGCAGATTAC TTCGTTAAAT TATTAAGGGA ATAGCCTCAG GCACTCTCAC	
ATGGGCAGCT GAGCATCATG GAGAGGATTG ACCGGGAGCA AATCTGCAGG CAGTCCCTTC	420
TACCCGTCGA CTCGTAGTAC CTCTCCTAAC TGGCCCTCGT TTAGACGTCC GTCAGGGAAG	
ACTGCAACCT GGCTTTGGAT GTGGTCAGCT TTTCCAAAGG ACACTTCAAG CTTCTGAACG	480
TGACGTTGGA CCGAAACCTA CACCAGTCGA AAAGGTTTCC TGTGAAGTTC GAAGACTTGC	
TGAAAGTGGA GGTGAGAGAC ATTAATGACC ATAGCCCTCA CTTTCCCAGT GAAATAATGC	540
ACTTTCACCT CCACTCTCTG TAATTACTGG TATCGGGAGT GAAAGGGTCA CTTTATTACG	
ATGTGGAGGT GTCTGAAAGT TCCTCTGTGG GCACCAGGAT TCCTTTAGAA ATTGCAATAG	600
TACACCTCCA CAGACTTTCA AGGAGACACC CGTGGTCCTA AGGAAATCTT TAACGTTATC	
ATGAAGATGT TGGGTCCAAC TCCATCCAGA ACTTTCAGAT CTCAAATAAT AGCCACTTCA	660
TACTTCTACA ACCCAGGTTG AGGTAGGTCT TGAAAGTCTA GAGTTTATTA TCGGTGAAGT	
GCATTGATGT GCTAACCAGA GCAGATGGGG TGAAATATGC AGATTTAGTC TTAATGAGAG	720
CGTAACTACA CGATTGGTCT CGTCTACCCC ACTTTATACG TCTAAATCAG AATTACTCTC	
AACTGGACAG GGAAATCCAG CCAACATACA TAATGGAGCT ACTAGCAATG GATGGGGGTG	780
TTGACCTGTC CTTTLAGGTC GGTGTATGT ATTACCTCGA TGATCGTTAC CTACCCCCAC	
TACCATCACT ATCTGGTACT GCAGTGGTTA ACATCCGAGT CCTGGACTTT AATGATAACA	840
ATGGTAGTGA TAGACCATGA CGTCACCAAT TGTAGGCTCA GGACCTGAAA TTACTATTGT	
GCCAGTGTT TGAGAGAAGC ACCATTGCTG TGGACCTAGT AGAGGATGCT CCTCTGGGAT	900
CGGGTCACAA ACTCTCTTCG TGGTAACGAC ACCTGGATCA TCTCCTACGA GGAGACCCTA	
ACCTTTTGTT GGAGTTACAT GCTACTGACG ATGATGAAGG AGTGAATGGA GAAATTGTTT	960
TGGAACAA CCTCAATGTA CGATGACTGC TACTACTTCC TCACTTACCT CTTTAAACAA	
ATGGATTCAG CACTTTGGCA TCTCAAGAGG TACGTCAGCT ATTTAAATTT AACTCCAGAA	1020
TACCTAAGTC GTGAAACCGT AGAGTTCTCC ATGCAGTCGA TAAATTTTAA TTGAGGTCTT	

CTGGCAGTGT	TACTCTTGAA	GGCCCAAGTTG	ATTTTGAGAC	CAAGCAGACT	TACGAATTTG	1080
GACCGTCACA	ATGAGAACTT	CCGGTTCAAC	TAAAACTCTG	GTTTCGTCTGA	ATGCTTAAAC	
AGGTACAAGC	CCAAGATTTG	GGCCCCAACC	CACTGACTGC	TACTTGTAAG	GTAAGTGTTC	1140
TCCATGTTTC	GGTTCTAAAC	CCGGGGTTGG	GTGACTGACG	ATGAACATTT	CATTGACAAG	
ATATACTTGA	TGTAAATGAT	AATACCCAG	CCATCACTAT	TACCCCTCTG	ACTACTGTAA	1200
TATATGAAC	ACATTTACTA	TTATGGGGTC	GGTAGTGATA	ATGGGGAGAC	TGATGACATT	
ATGCAGGAGT	TGCCTATATT	CCAGAAACAG	CCACAAAGGA	GAACTTTATA	GCTCTGATCA	1260
TACGTCCTCA	ACGGATATAA	GGTCTTTGTC	GGTGTTCCT	CTTGAAATAT	CGAGACTAGT	
GCACTACTGA	CAGAGCCTCT	GGATCTAATG	GACAAGTTCG	CTGTACTCTT	TATGGACATG	1320
CGTGATGACT	GTCTCGGAGA	CCTAGATTAC	CTGTTCAAGC	GACATGAGAA	ATACCTGTAC	
AGCACTTTAA	ACTACAGCAA	GCTTATGAGG	ACAGTTACAT	GATAGTTACC	ACCTCTACTT	1380
TCGTGAAATT	TGATGTCGTT	CGAATACTCC	TGTCAATGTA	CTATCAATGG	TGGAGATGAA	
TAGACAGGGA	AAACATAGCA	GCGTACTCTT	TGACAGTAGT	TGCAGAAGAC	CTTGGCTTCC	1440
ATCTGTCCCT	TTTGTATCGT	CGCATGAGAA	ACTGTCATCA	ACGTCTTCTG	GAACCGAAGG	
CCTCATTGAA	GACCAAAAAG	TACTACACAG	TCAAGGTTAG	TGATGAGAAT	GACAATGCAC	1500
GGAGTAACTT	CTGGTTTTTC	ATGATGTGTC	AGTTCCAATC	ACTACTCTTA	CTGTTACGTG	
CTGTATTTTC	TAAACCCCAG	TATGAAGCTT	CTATTCTGGA	AAATAATGCT	CCAGGCTCTT	1560
GACATAAAAG	ATTTGGGGTC	ATACTTCGAA	GATAAGACCT	TTTATTACGA	GGTCCGAGAA	
ATATAACTAC	AGTGATAGCC	AGAGACTCTG	ATAGTGATCA	AAATGGCAAA	GTAAATTACA	1620
TATATTGATG	TCACTATCGG	TCTCTGAGAC	TATCACTAGT	TTTACCGTTT	CATTTAATGT	
GACTTGTGGA	TGCAAAAGTG	ATGGGCCAGT	CACTAACAAC	ATTTGTTTCT	CTTGATGCGG	1680
CTGAACACCT	ACGTTTTTAC	TACCCGGTCA	GTGATTGTTG	TAAACAAAGA	GAAGTACGCC	
ACTCTGGAGT	ATTGAGAGCT	GTTAGGTCTT	TAGACTATGA	AAAACTTAAA	CAACTGGATT	1740
TGAGACCTCA	TAAGTCTCGA	CAATCCAGAA	ATCTGATACT	TTTTGAATTT	GTTGACCTAA	
TTGAAATTGA	AGCTGCAGAC	AATGGGATCC	CTCAACTCTC	CACTCGCGTT	CAACTAAATC	1800
AACTTTAACT	TCGACGTCTG	TTACCCTAGG	GAGTTGAGAG	GTGAGCGCAA	GTTGATTTAG	
TCAGAATAGT	TGATCAAAAT	GATAATTGCC	CTGTGATAAC	TAATCCTCTT	CTTAATAATG	1860
AGTCTTATCA	ACTAGTTTTA	CTATTACGG	GACACTATTG	ATTAGGAGAA	GAATTATTAC	
GCTCGGGTGA	AGTTCGTCTT	CCCATCAGCG	CTCCTCAAAA	CTATTTAGTT	TTCCAGCTCA	1920
CGAGCCCACT	TCAAGACGAA	GGGTAGTCGC	GAGGAGTTTT	GATAAATCAA	AAGGTCGAGT	
AAGCCGAGGA	TTCAGATGAA	GGGCACAAC	CCCAGCTGTT	CTATACCATA	CTGAGAGATC	1980
TTCCGGCTCCT	AAGTCTACTT	CCCGTGTGTA	GGGTCGACAA	GATATGGTAT	GACTCTCTAG	
CAAGCAGATT	GTTTGCCATT	AACAAAGAAA	GTGGTGAAAT	GTTCTGAAA	AAACAATTAA	2040
GTTTCGTCTAA	CAACCGGTAA	TTGTTTCTTT	CACCACTTCA	CAAGGACTTT	TTTGTTAATT	
ACTCTGACCA	TTCAGAGGAC	TTGAGCATAG	TAGTTGCAGT	GTATGACTTG	GGAAGACCTT	2100
TGAGACTGGT	AAGTCTCCTG	AAGTCTGATC	ATCAACGTCA	CATACTGAAC	CCTTCTGGAA	
CATTATCCAC	CAATGCTACA	GTAAATTCA	TCCTCACCGA	CTCTTTTCTT	TCTAACGTTG	2160
GTAATAGGTG	GTTACGATGT	CAATTTAAGT	AGGAGTGGCT	GAGAAAAGGA	AGATTGCAAC	

Fig. 6. (Continuation page 2, SEQ ID NO:6).

ATTAAATCCA	CAGACCTACA	GTCAAATATT	TGAGGGCCCC	TGAAACAGCA	CATCAGTCAG	3360
TAATTTAGGT	GTCTGGATGT	CAGTTTATAA	ACTCCCGGGG	ACTTTGTCGT	GTAGTCAGTC	
GACCTAAAGT	GGCCTTTTTA	CTTTTAGCAG	CTCCTGGGTC	TGCCCTCTGT	GTTAATCAGC	3420
CTGGATTTC	CCGGAAAAAT	GAAAATCGTC	GAGGACCCAG	ACGGGAGACA	CAATTAGTCG	
CCCTGGTCAA	GTCCTGAGTA	GGATCATGGC	GTTTTTATAT	GCATCTCACC	TACTTTGGAC	3480
GGGACCAGTT	CAGGACTCAT	CCTAGTACCG	CAAAAATATA	CGTAGAGTGG	ATGAAACCTG	
GTGATTTACA	CATAATAGGA	AACGCTTGGT	TTCAGTGAAG	TCTGTGTTGT	ATATATTCTG	3540
CACTAAATGT	GTATTATCCT	TTGCGAACCA	AAGTCACTTC	AGACACAACA	TATATAAGAC	
TTATATACAC	GCATTTTGTG	TTTGTGTATA	TATTTCAAGT	CCATTTCAGAT	ATGTGTATAT	3600
AATATATGTG	CGTAAACAC	AAACACATAT	ATAAAGTTCA	GGTAAGTCTA	TACACATATA	
AGTGCAGACC	TTGTAAATTA	AATATTCTGA	TACTTTTTC	TCAATAAATA	TTTAAAT	
TCACGTCTGG	AACATTTAAT	TTATAAGACT	ATGAAAAAGG	AGTTATTTAT	AAATTTA	

Fig. 6. (Continuation page 4, SEQ ID NO:6).

00903471-074404

MVCCGPGRML LGWAGLLVLA ALCLLQVPGA QAAACEPVRI PLCKSLPWNM TKMPNHLHHS	60
TQANAILAME QFEGLLGTHC SPDLLFFLCA MYAPICTIDF QHEPIKPCKS VCERARQGCE	120
PILIKYRHSW PESLACDELP VYDRGVCISP EAIVTADGAD FPMDSSSTGHC RGASSERCKC	180
KPV RATQKTY FRNNYNYVIR AKVKEVKMKC HDVTAVVEVK EILKASLVNI PRDTVNLYTT	240
SGCLCPPLTV NEEYVIMGYE DEERSRLLLV EGSIAEKWKD RLGKKVKRWD MKLRHLGLGK	300
TDASDSTQNQ KSGRNSNPRP ARS.	

Figure 7. Deduced amino acid sequence of mouse FRZB-1 protein. SEQ ID NO:7.

FRZB-1

[illegible]

AAGCCTGGGA TTCGGACCCT	CCATGGTCTG GGTACCAGAC	CTGCGGCCCG GACGCCGGGC	GGACGGATGC CCTGCCTACG	TGCTAGGATG ACGATCCTAC	GGCCGGGTTG CCGCCCCAAC	60
CTAGTCCTGG GATCAGGACC	CTGCTCTCTG GACGAGAGAC	CCTGCTCCAG GGACGAGGTC	GTGCCCCGGAG CACGGGCCTC	CTCAGGCTGC GAGTCCGACG	AGCCTGTGAG TCGGACACTC	120
CCTGTCCGCA GGACAGGCGT	TCCCCGCTGTG AGGGCGACAC	CAAGTCCCTT GTTCAGGGAA	CCCTGGAACA GGGACCTTGT	TGACCAAGAT ACTGGTTCTA	GCCCAACCAC CGGGTTGGTG	180
CTGCACCACA GACGTGGTGT	GCACCCAGGC CGTGGGTCCG	TAACGCCATC ATTGCGGTAG	CTGGCCATGG GACCGGTACC	AACAGTTCGA TTGTCAAGCT	AGGGCTGCTG TCCCACGAC	240
GGCACCCTACT CCGTGGGTGA	GCAGCCCGGA CGTCGGGCCT	TCTTCTCTTC AGAAGAGAAG	TTCCTCTGTG AAGGAGACAC	CAATGTACGC GTTACATGCG	ACCCATTTGC TGGGTAAACG	300
ACCATCGACT TGGTAGCTGA	TCCAGCACGA AGGTCGTGCT	GCCCATCAAG CGGGTAGTTC	CCCTGCAAGT GGGACGTTCA	CTGTGTGTGA GACACACACT	GCGCGCCCGA CGCGCGGGCT	360
CAGGGCTGCG GTCCCACGCG	AGCCCATTTCT TCGGGTAAGA	CATCAAGTAC GTAGTTCATG	CGCCACTCGT GCGGTGAGCA	GGCCGGAAAG CCGGCCTTTC	CTTGGCCTGC GAACCGGACG	420
GACGAGCTGC CTGCTCGACG	CGGTGTACGA GCCACATGCT	CCGCGGCGTG GGCGCCGCAC	TGCATCTCTC ACGTAGAGAG	CTGAGGCCAT GACTCCGGTA	CGTCACCGCG GCAGTGGCGC	480
GACGGAGCGG CTGCCTCGCC	ATTTTCCCTAT TAAAAGGATA	GGATTCAAGT CCTAAGTTCA	ACTGGACACT TGACCTGTGA	GCAGAGGGGC CGTCTCCCCG	AAGCAGCGAA TTCGTGCTTT	540
CGTTGCAAAT GCAACGTTTA	GTAAGCCTGT CATTCGGACA	CAGAGCTACA GTCTCGATGT	CAGAAGACCT GTCTTCTGGA	ATTTCCGGAA TAAAGGCCTT	CAATTACAAC GTTAATGTTG	600
TATGTCATCC ATACAGTAGG	GGGCTAAAGT CCCGATTTCA	TAAAGAGGTA ATTTCTCCAT	AAGATGAAAT TTCTACTTTA	GTCATGATGT CAGTACTACA	GACCGCCGTT CTGGCGGCAA	660
GTGGAAGTGA CACCTTCACT	AGGAAATTCT TCCTTTAAGA	AAAGGCATCA TTTCCGTAGT	CTGGTAAACA GACCATTTGT	TTCCAAGGGA AAGGTTCCCT	CACCGTCAAT GTGGCAGTTA	720
CTTTATACCA GAAATATGGT	CCTCTGGCTG GGAGACCGAC	CCTCTGTCCT GGAGACAGGA	CCACTTACTG GGTGAATGAC	TCAATGAGGA AGTTACTCCT	ATATGTCATC TATACAGTAG	780
ATGGGCTATG TACCCGATAC	AAGACGAGGA TTCTGCTCCT	ACGTTCCAGG TGCAAGGTCC	TTACTCTTGG AATGAGAACC	TAGAAGGCTC ATCTTCCGAG	TATAGCTGAG ATATCGACTC	840
AAGTGGAAGG TTCACCTTCC	ATCGGCTTGG TAGCCGAACC	TAAGAAAGTC ATTCTTTTCA	AAGCGCTGGG TTCGCGACCC	ATATGAAACT TATACTTTGA	CCGACACCTT GGCTGTGGAA	900
GGACTGGGTA CCTGACCCAT	AAACTGATGC TTTGACTACG	TAGCGATTCC ATCGCTAAGG	ACTCAGAATC TGAGTCTTAG	AGAAGTCTGG TCTTCAGACC	CAGGAACTCT GTCCTTGAGA	960

ATAAATAAAAT	TTGGCTTGCT	GTATTGGCCA	GGAAAAGAAA	GTATTAAAGT	ATGCATGCAT	1860
TATTTATTTA	AACCGAACGA	CATAACCGGT	CCTTTTCTTT	CATAATTTCA	TACGTACGTA	
GTGCACCAGG	GTGTTATTTA	ACAGAGGTAT	GTAAGTCTAT	AAAAGACTAT	AATTTACAGG	1920
CACGTGGTCC	CACAAATAAA	TGTCTCCATA	CATTGAGATA	TTTTCTGATA	TTAAATGTCC	
ACACGGAAAT	GTGCACATTT	GTTTACTTTT	TTTCTTCCTT	TTGCTTTGGG	CTTGTGATTT	1980
TGTGCCTTTA	CACGTGTAAA	CAAATGAAAA	AAAGAAGGAA	AACGAAACCC	GAACACTAAA	
TGGTTTTTTGG	TGTGTTTATG	TCTGTATTTT	GGGGGGTGGG	TAGGTTTAAG	CCATTGCACA	2040
ACCAAAAACC	ACACAAATAC	AGACATAAAA	CCCCCACCC	ATCCAAATTC	GGTAACGTGT	
TTCAAGTTGA	ACTAGATTAG	AGTAGACTAG	GCTCATTTGGC	CTAGACATTA	TGATTTGAAT	2100
AAGTTCAACT	TGATCTAATC	TCATCTGATC	CGAGTAACCG	GATCTGTAAT	ACTAAACTTA	
TTGTGTTGTT	TAATGCTCCA	TCAAGATGTC	TAATAAAAAGG	AATATGGTTG	TCAACAGAGA	2160
AACACAACAA	ATTACGAGGT	AGTTCTACAG	ATTATTTTCC	TTATACCAAC	AGTTGTCTCT	
CGACAACAAC	AACAAA					
GCTGTTGTTG	TTGTTT					

[illegible]

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Figure 10. Nucleotide sequence of the full-length human FRZB-1 cDNA. SEQ ID NO:10.

This sequence was assembled from public ESTs from the Genbank database

(accession numbers: H18848, R63748, W38677, W44760, H38379 and N71244).

GGCGGAGCGG GCCTTTTGGC GTCCACTGCG CGGCTGCACC CTGCCCCATC TGCCGGGATC 60
CCGCCTCGCC CGGAAAACCG CAGGTGACGC GCCGACGTGG GACGGGGTAG ACGGCCCTAG
ATGGTCTGCG GCAGCCCGGG AGGGATGCTG CTGCTGCGGG CCGGGCTGCT TGCCCTGGCT 120
TACCAGACGC CGTCGGGCCC TCCCTACGAC GACGACGCCC GGCCCGACGA ACGGGACCGA
GCTCTCTGCC TGCTCCGGGT GCGCGGGGCT CGGGCTGCAG CCTGTGAGCC CGTCCGCATC 180
CGAGAGACGG ACGAGGCCCA CGGGCCCCGA GCCCGACGTC GGACACTCGG GCAGGCGTAG
CCCCTGTGCA AGTCCCTGCC CTGGAACATG ACTAAGATGC CCAACCACCT GCACCACAGC 240
GGGGACACGT TCAGGGACGG GACCTTGTA C TGATTCTACG GGTGTTGGTGA CGTGGTGTCTG
ACTCAGGCCA ACGCCATCCT GGCCATCGAG CAGTTCGAAG GTCTGCTGGG CACCCACTGC 300
TGAGTCCGGT TGCGGTAGGA CCGGTAGCTC GTCAAGCTTC CAGACGACCC GTGGGTGACG
AGCCCCGATC TGCTCTTCTT CCTCTGTGCC ATGTACGCGC CCATCTGCAC CATTGACTTC 360
TCGGGGCTAG ACGAGAAGAA GGAGACACGG TACATGCGCG GGTAGACGTG GTAAGTGAAG
CAGCACGAGC CCATCAAGCC CTGTAAGTCT GTGTGCGAGC GGGCCCCGCA GGGCTGTGAG 420
GTCGTGCTCG GGTAGTTCGG GACATTCAGA CACACGCTCG CCCGGGCCGT CCCGACACTC
CCCATACTCA TCAAGTACCG CCACTCGTGG CCGGAGAACC TGGCCTGCGA GGAGCTGCCA 480
GGGTATGAGT AGTTCATGGC GGTGAGCACC GGCCTCTTGG ACCGGACGCT CCTCGACGGT
GTGTACGACA GGGGCGTGTG CATCTCTCCC GAGGCCATCG TTAGTGCGGA CGGAGCTGAT 540
CACATGCTGT CCGCGCACAC GTAGAGAGGG CTCGGGTAGC AATGACGCCT GCCTCGACTA
TTTCCTATGG ATTCTAGTAA CGGAAACTGT AGAGGGGCAA GCAGTGAACG CTGTAAATGT 600
AAAGGATACC TAAGATCAT TGCCTTTGACA TCTCCCCGTT CGTCACTTGC GACATTTACA
AAGCCTATTA GAGCTACACA GAAGACCTAT TTCCGGAACA ATTACAATA TGTCATTCGG 660
TTCGGATAAT CTCGATGTGT CTTCTGGATA AAGGCCTTGT TAATGTTGAT ACAGTAAGCC
GCTAAAGTTA AAGAGATAAA GACTAAGTGC CATGATGTGA CTGCAGTAGT GGAGGTGAAG 720
CGATTTCAAT TTCTCTATTT CTGATTCACG GTACTACACT GACGTCATCA CCTCCACTTC
GAGATTCTAA AGTCCTCTCT GGTAACATT CCACGGGACA CTGTCAACCT CTATACCAGC 780
CTCTAAGATT TCAGGAGAGA CCATTTGTAA GGTGCCCTGT GACAGTTGGA GATATGGTCTG
TCTGGCTGCC TCTGCCCTCC ACTTAATGTT AATGAGGAAT ATATCATCAT GGGCTATGAA 840
AGACCGACGG AGACGGGAGG TGAATTACAA TTAAGTCTTA TATAGTAGTA CCCGATACTT

GATGAGGAAC	GTTCAGATT	ACTCTGGTG	GAAGGCTCTA	TAGCTGAGAA	GTGGAAGGAT	900
CTACTCCTTG	CAAGGTCTAA	TGAGAACCAC	CTTCCGAGAT	ATCGACTCTT	CACCTTCCTA	
CGACTCGGTA	AAAAAGTTAA	GCGCTGGGAT	ATGAAGCTTC	GTCATCTTGG	ACTCAGTAAA	960
GCTGAGCCAT	TTTTTCAATT	CGCGACCCTA	TACTTCGAAG	CAGTAGAACC	TGAGTCATTT	
AGTGATTCTA	GCAATAGTGA	TTCCACTCAG	AGTCAGAAGT	CTGGCAGGAA	CTCGAACCCC	1020
TCACTAAGAT	CGTTATCACT	AAGGTGAGTC	TCAGTCTTCA	GACCGTCCTT	GAGCTTGGGG	
CGGCAAGCAC	GCAACTAAAT	CCCGAAATAC	AAAAAGTAAC	ACAGTGGACT	TCCTATTAAG	1080
GCCGTTTCGTG	CGTTGATTTA	GGGCTTTATG	TTTTTTCATTG	TGTCACCTGA	AGGATAATTC	
ACTTACTTGC	ATTGCTGGAC	TAGCAAAGGA	AAATTGCACT	ATTGCACATC	ATATTCTATT	1140
TGAATGAACG	TAACGACCTG	ATCGTTTCCT	TTTAACGTGA	TAACGTGTAG	TATAAGATAA	
GTTTACTATA	AAAATCATGT	GATAACTGAT	TATTACTTCT	GTTTCTCTTT	TGGTTTCTGC	1200
CAAATGATAT	TTTTAGTACA	CTATTGACTA	ATAATGAAGA	CAAAGAGAAA	ACCAAAGACG	
TTCTCTCTTC	TCTCAACCCC	TTTGTAAATGG	TTTGGGGGCA	GA CTCTTAAG	TATATTGTGA	1260
AAGAGAGAAG	AGAGTTGGGG	AAACATTACC	AAACCCCCGT	CTGAGAATTC	ATATAACACT	
GTTTTCTATT	TCACTAATCA	TGAGAAAAAC	TGTTCTTTTG	CAATAATAAT	AAATTAAACA	1320
CAAAAGATAA	AGTGATTAGT	ACTCTTTTTG	ACAAGAAAAC	GTTATTATTA	TTTAATTTGT	
TGCTGTTACC	AGAGCCTCTT	TGCTGAGTCT	CCAGATGTTA	ATTTACTTTT	TGCACCCCCA	1380
ACGACAATGG	TCTCGGAGAA	ACGACTCAGA	GGTCTACAAT	TAAATGAAAG	ACGTGGGGTT	
TTGGGAATGC	AATATTGGAT	GAAAAGAGAG	GTTTCTGGTA	TTTACAGAAA	GCTAGATATG	1440
AACCCTTACG	TTATAACCTA	CTTTTCTCTC	CAAAGACCAT	AAGTGTCTTT	CGATCTATAC	
CCTTAAAACA	TACTCTGCCG	ATCTAATTAC	AGCCTTATTT	TTGTATGCCT	TTTGGGCATT	1500
GGAATTTTGT	ATGAGACGGC	TAGATTAATG	TCGGAATAAA	AACATACGGA	AAACCCGTAA	
CTCCTCATGC	TTAGAAAAGTT	CCAAATGTTT	ATAAAAGGTAA	AATGGCAGTT	TGAAGTCAAA	1560
GAGGAGTACG	AATCTTTCAA	GGTTTACAAA	TATTTCCATT	TTACCGTCAA	ACTTCAGTTT	
TGTCACATAG	GCAAAGCAAT	CAAGCACCAG	GAAGTGTTTA	TGAGGAAACA	ACACCCAAGA	1620
ACAGTGTATC	CGTTTCGTTA	GTTCTGGTTC	CTTCACAAAT	ACTCCTTTGT	TGTGGGGTCT	
TGAATTATTT	TTGAGACTGT	CAGGAAGTAA	AATAAATAGG	AGCTTAAGAA	AGAACATTTT	1680
ACTTAATAAA	AACCTTGACA	GTCCTTCATT	TTATTTATCC	TCGAATTCCT	TCTTGTAATA	
GCCTGATTGA	GAAGCACAAAC	TGAAACCAGT	AGCCGCTGGG	GTGTTAATGG	TAGCATTCCT	1740
CGGACTAACT	CTTCGTGTTG	ACTTTGGTCA	TCGGCGACCC	CACAATTACC	ATCGTAAGAA	
CTTTTGGCAA	TACATTTGAT	TTGTTTCATGA	ATATATTAAT	CAGCATTAGA	GAAATGAATT	1800
GAAACCGTT	ATGTAAACTA	AACAAGTACT	TATATAATTA	GTCGTAATCT	CTTTACTTAA	
ATAACTAGAC	ATCTGCTGTT	ATCACCATAG	TTTTGTTTAA	TTTGCTTCCT	TTTAAATAAA	1860
TATTGATCTG	TAGACGACAA	TAGTGGTATC	AAAACAAATT	AAACGAAGGA	AAATTTATTT	
CCCATTTGGTG	AAAGTCAAAA	AAAAAAAAAA	AAA			
GGGTAACCAC	TTTCAGTTTT	TTTTTTTTTT	TTT			